

**LOS ANGELES DREDGED MATERIAL MANAGEMENT PLAN (DMMP)**  
**DEVELOPMENT OF A REGIONAL TREATMENT FACILITY**  
**FOR USE IN SOUTHERN CALIFORNIA**  
**TECHNICAL MEMORANDUM**



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of Engineers®**  
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## TABLE OF CONTENTS

1.	BACKGROUND .....	1.1
2.	FIELD PILOT STUDY.....	2.1
2.1	Background .....	2.1
2.2	Field Test Program .....	2.2
2.3	Pilot Test Results.....	2.12
2.4	Production Rates and Costs.....	2.24
2.5	Areas for Improvement .....	2.25
3.	DEVELOPMENT OF A REGIONAL STAR FACILITY .....	3.1
3.1	Site Requirements .....	3.1
3.2	Treatment Approach & STAR Facility Design .....	3.1
3.3	Potential STAR Facility Locations .....	3.2
3.4	Potential Production Rate and Operation Cost.....	3.12
3.5	Construction and Permitting .....	3.13
3.6	Model for Long-Term Management and Operation .....	3.13
4.	SUMMARY AND RECOMMENDATION .....	4.1
5.	REFERENCE.....	5.1

## **LIST OF FIGURES**

Figure 2.1	Hydrocyclone Field Pilot Study Treatment Design .....	2.6
Figure 2.2	LARE Hydrocyclone Field Pilot Study Barge Layout .....	2.7
Figure 2.3	Field Pilot Study Barge Layout .....	2.8
Figure 2.4	Field Pilot Study – Manson Work Barge and Dredge Material .....	2.8
Figure 2.5	Aerial view of Tri-Flo International Hydrocyclone and Scalper Unit.....	2.9
Figure 2.6	Aerial View of Hydrocyclone, Baker Tanks, Settling Tanks and Generator.....	2.9
Figure 2.7	Field Pilot Study – Hydrocyclone in Operation. ....	2.10
Figure 2.8	LARE Debris Removed from Scalper Unit.....	2.10
Figure 2.9	Field Pilot Study – Washed Sand Output from 10” Hydrocyclone .....	2.11
Figure 2.10	Washed Sand after 24, 48, and 96 Hour Post Processing (right to left) ...	2.11
Figure 2.11	Sand Separation Results for Metals .....	2.14
Figure 2.12	Sand Separation Results for Organics .....	2.15
Figure 2.13	Washing Experiment Results for Metals.....	2.16
Figure 2.14	Washing Experiment Results for Organics .....	2.17
Figure 2.15	Washing Experiment Results for Total Organic Carbon .....	2.18
Figure 2.16	Sludge Concentration Comparisons .....	2.19
Figure 3.1	Sediment Treatment and Reuse Site Treatment Design Option #1 (Hydraulic Dredging).....	3.3
Figure 3.2	Sediment Treatment and Reuse Site Treatment Design Option #2 (Mechanical Dredging).....	3.4
Figure 3.3	Potential Locations of STAR Facility Sites.....	3.5
Figure 3.4	Proposed Marina del Rey Landfill.....	3.7
Figure 3.5	Marina del Rey Site .....	3.8
Figure 3.6	Anaheim Street Site.....	3.9
Figure 3.7	Proposed Long Beach CDF Site.....	3.10
Figure 3.8	Long Beach Shoreline Marina Site .....	3.11

LIST OF TABLES

Table 1.1 CSTF Membership and Participation..... 1.1

Table 2.1 Sediment Data Summary..... 2.3

Table 2.2 Field Pilot Study – Sediment Sample Log ..... 2.13

Table 2.3 Water Data Summary ..... 2.22

Table 2.4 Field Pilot Study – Process Water Sample Log ..... 2.24

Table 2.5 Pilot Study Equipment Comparison to Equipment Capacity ..... 2.25

## 1. BACKGROUND

Throughout Southern California, there is an imminent need for “feasible” contaminated sediment disposal alternatives to support dredging activities under various maintenance and capital improvement projects. Despite the ongoing efforts of local and State regulatory agencies, there remains a lack of readily available, and economical, disposal options for these sediments. To support the development of a regional Dredged Materials Management Plan (DMMP), the U.S. Army Corps of Engineers, Los Angeles District (USACE-LAD) recently completed (2004) a Baseline Conditions (F3) Report to begin the process for developing solutions to this regional problem. The DMMP F3 report describes a series of dredged material management alternatives and recommends specific approaches for further evaluation. One of the alternatives under consideration is the development of a regional Storage, Treatment, And Reprocessing (STAR) facility, located in a central area of the Los Angeles Region, where dredged material can be stored, treated to reduce chemical concentrations or enhance it geotechnically, and then made available for beneficial reuse purposes.

The concept for STAR facility development resulted from the recent activities of the Los Angeles Contaminated Sediments Task Force (CSTF). The CSTF was formed by the State of California back in 1997 to address regional issues associated with dredging contaminated sediments. The complete list of the CSTF participants is provided in Table 1.1. Recently, CSTF completed a long-term contaminated sediment management strategy (CSTF 2005) to outline a plan for the region. The CSTF strategy document relies heavily on the concept of balancing beneficial reuse against upland and aquatic disposal options for contaminated materials with a future goal of achieving 100% beneficial reuse of dredge materials.

**Table 1.1 CSTF Membership and Participation**

AGENCY/ORGANIZATION	CSTF OVERSIGHT RESPONSIBILITIES	MEETING PARTICIPANT	MOU SIGNATORY
California Coastal Commission	√	√	√
Los Angeles Regional Water Quality Control Board	√	√	√
California Department of Fish and Game		√	
City of Long Beach		√	√
County of Los Angeles Beaches and Harbors		√	√
Heal the Bay		√	
Port of Long Beach		√	√
Port of Los Angeles		√	√
Southern California Coastal Water Research Project		√	
U.S. Army Corps of Engineers		√	√
U.S. Environmental Protection Agency		√	√
NOAA Fisheries		√	

Unfortunately, CSTF involvement in developing beneficial reuse opportunities was limited to researching potential markets for treated contaminated sediments in the Los Angeles Region, and not on the actual treatment processes that might be suitable for use within the region. As such, no studies were conducted specifically to develop treatment procedures or to evaluate feasibility and costs associated with developing a regional facility dedicated to storing and/or treating dredge materials for beneficial reuse within the region, hence the need for the current study.

Evaluated individually, contaminated sediment treatment alternatives almost always cost more than aquatic disposal or near shore fill options. In an effort to identify means for promoting treatment and beneficial reuse opportunities within the Los Angeles region, the CSTF members developed a concept (the STAR facility) for a regional processing facility where sediments could be stored, treated and then reused, on an as needed basis, in various upland applications such as fill material, cement products, landfill daily cover, roadway base material, etc. This concept offers the following advantages:

- Capital development costs can be amortized for the facility over multiple projects/years vs. each project;
- Provides ability to develop larger processing facility which will lower per unit treatment costs;
- Provides opportunity to combine disposal permitting efforts by maintaining a single user permit for operating the facility;
- Allows for temporary storage of dredge material so that treatment can occur independent of dredging;
- By storing and treating the material over longer timeframes it will provide for a more constant supply of end use products for export;
- Locating the facility near regional distribution points (e.g., rail lines or waterways) will provide for greater opportunities to locate end users; and
- Provides a long-term and environmentally protective solution to the regional problem of contaminated sediment disposal.

To support the ongoing development of a regional STAR facility, and to develop contaminated sediment disposal alternatives for dredging needs at one of its authorized navigation sites, Port Hueneme, the USACE recently completed a series of studies to begin developing potential treatment technologies for use individually or at such a facility. This document presents the results of one potential treatment technology, sand separation, where readily available particle size separation equipment can be used to reduce contaminant concentrations and produce a reusable by-product (clean sand) for regional beach nourishment.

The objectives of this technical memorandum are to present the results of the sand separation treatment study, and to develop a conceptual layout for a regional STAR facility at various potential sites in the LA Region using the findings (e.g. technical feasibility, production rate, cost) of the pilot study and coordination with local sponsors. A summary of the pilot study is provided in Section 2, and the development of a conceptual regional STAR facility using this technology is discussed later in Section 3. Lastly, recommendations for additional work to further develop the STAR facility are provided in Section 4.

## **2. FIELD PILOT STUDY**

### **2.1 BACKGROUND**

To support the beneficial reuse goals of the CSTF and to identify methods for treating contaminated sediments generated during Federal maintenance dredging projects within the Los Angeles Basin, the Los Angeles District Corps of Engineers has been working to develop potential contaminated sediment treatment technologies. One method under consideration is the use of mechanical sand separation to reduce or isolate contaminant concentrations and produce a reusable by-product (clean sand) for regional beach nourishment.

The concept for the sand separation treatment approach lies in the assumption that most contaminants are tightly bound to the fine-grained and organic fractions of the sediment and not strongly associated with the coarser sand fractions. Therefore, if a mechanical process were available to effectively separate the coarse sand fraction from the fine-grained and organic material, it should be possible to concentrate the contaminants into a de-watered, fine-grained cake for disposal and produce “clean” water and sand as re-useable by-products.

One commercially available method for mechanically separating the sand from the fine-grained fractions is to use a hydrocyclone. Hydrocyclones are large conical shaped devices that produce a vortex of the sediment slurry which allows the heavier sand fractions to migrate to the outside of the cone and drop out in the underflow while the less dense, finer-grained fractions are carried to the center of the cone and flow out the top as the overflow. This fine-grained slurry (overflow) can then be transferred to a second piece of equipment (e.g., belt press) and dewatered to produce a dry cake with the waste water either being reused for additional dredge slurry or discharged back to the sample location.

To test this approach, a laboratory bench-scale study was conducted using sieves by the US Army Corps of Engineers Engineering Research and Development Center (USACE 2005) to gather data to assist in evaluating the feasibility of this approach for use in a regional contaminated dredge material treatment facility. The results of that bench scale study showed that the approach had the potential to be effective in reducing contaminant concentrations for both metals and organics, but it needed to be tested using full sized field equipment. As such, an initial field pilot study was conducted to validate the results of the laboratory bench scale study using actual hydrocyclones. To complete this task, contaminated sediment was collected in the field and sent to a hydrocyclone equipment manufacturer in Texas for testing which also showed promising results. The next step was to conduct the hydrocyclone sand separation pilot study using full-scale, commercially



available, equipment outfitted with larger cone sizes for larger sand fraction recovery and larger test volumes.

The preliminary bench-scale separation study was conducted to test the technology using a 4-inch hydrocyclone which produced a sand cut size of approximately 35 microns. While substantial reductions in contaminant concentrations were achieved for this size fraction, the goal of the technology was to produce beach compatible material which typically has larger grain sizes than 35 microns. Since larger cut sizes using hydrocyclones are achieved by using a larger cone size in the system, a field pilot study was initiated to use a 10-inch cone capable of producing a cut at approximately 75 microns which would be more representative for beach nourishment. The design and test results for the full-scale field pilot study are summarized below

## **2.2 FIELD TEST PROGRAM**

### **Test Material**

The test material for the field pilot study was sediment dredged in June 2005 from the mouth of the Los Angeles River Estuary (LARE), just upstream of the Queensway Bridge in the City of Long Beach, as part of an emergency dredging effort to restore navigation depths to the entrance channel for the Catalina Cruises Ferry Terminal. Approximately 800 cubic yards of sediment were dredged by Manson Construction using a clamshell bucket and placed onto a flat deck barge containing "K" rails to prevent the material from sloughing off back into the water. Bulk sediment chemistry for the dredge material is presented in Table 2.1, and shows elevated concentrations for both metals and organics. Table 2.1 also includes sediment chemistry results for the processed sands that will be discussed in Section 2.3.

Two sources of bulk sediment chemistry data are available: (1) results from the pre-dredge characterization which are labeled as "Area 1-2 top and bottom", and (2) results from samples collected after stockpiling it on the flat deck barge just prior to processing. These latter samples were collected from two areas of the barge, one area contained sediment with a high sand content and one area contained sediment with high silt/clay content. This was done to provide a range of potential analytical results as the LARE area is typically variable with respect to grain size and chemical composition.

(1 of 2)

## 2.3

(2 of 2)

## 2.4

## **Study Design & Equipment**

Due to logistical constraints related to obtaining access to a suitable upland location for conducting the pilot study, the actual program was conducted entirely on barges anchored at the mouth of the Los Angeles River near the entrance to the Rainbow Harbor. The treatment design for the study is presented schematically in Figure 2.1 and the barge layout is shown in Figure 2.2. The treatment process included the following key steps:

- Prepare dredge material slurry using bulk sediment and site water to a target suspension of 10 -15% solids;
- Pass the material through a scalper (shaker) screen to remove trash and debris;
- Pass the remaining material through a 10" hydrocyclone to remove all material above 75 microns;
- Pass the remaining material through a bank of 4" hydrocyclones to remove the material between 35 and 75 microns;
- Transfer the residual slurry to settling tanks to allow some of the remaining particulates to drop out; and
- Reroute settled slurry water back to slurry tank to mix with new bulk material or allow continuing settling and then decanting clarified water back to dredge site.
- Dispose all trash and woody debris from the scalper screen, along with residual solids from the settling tanks, at landfill or suitable port disposal area.

Since the project included dredging the Los Angeles River Estuary, the City of Long Beach paid for the sediment removal and the USACE funded the actual costs of the field study and analytical testing program. Field equipment used for this study was provided by the following:

- Manson Construction – prime contractor and project management, derrick barge, field crew, generator, slurry tank, Baker tanks and settling tanks
- Tri-Flo International – hydrocyclones, pumps, and field crew
- Connolly Pacific – flat deck barges

Photographs of the test equipment, barge layout, and pre- and post-treated sediments are shown in Figures 2.3 through 2.10.

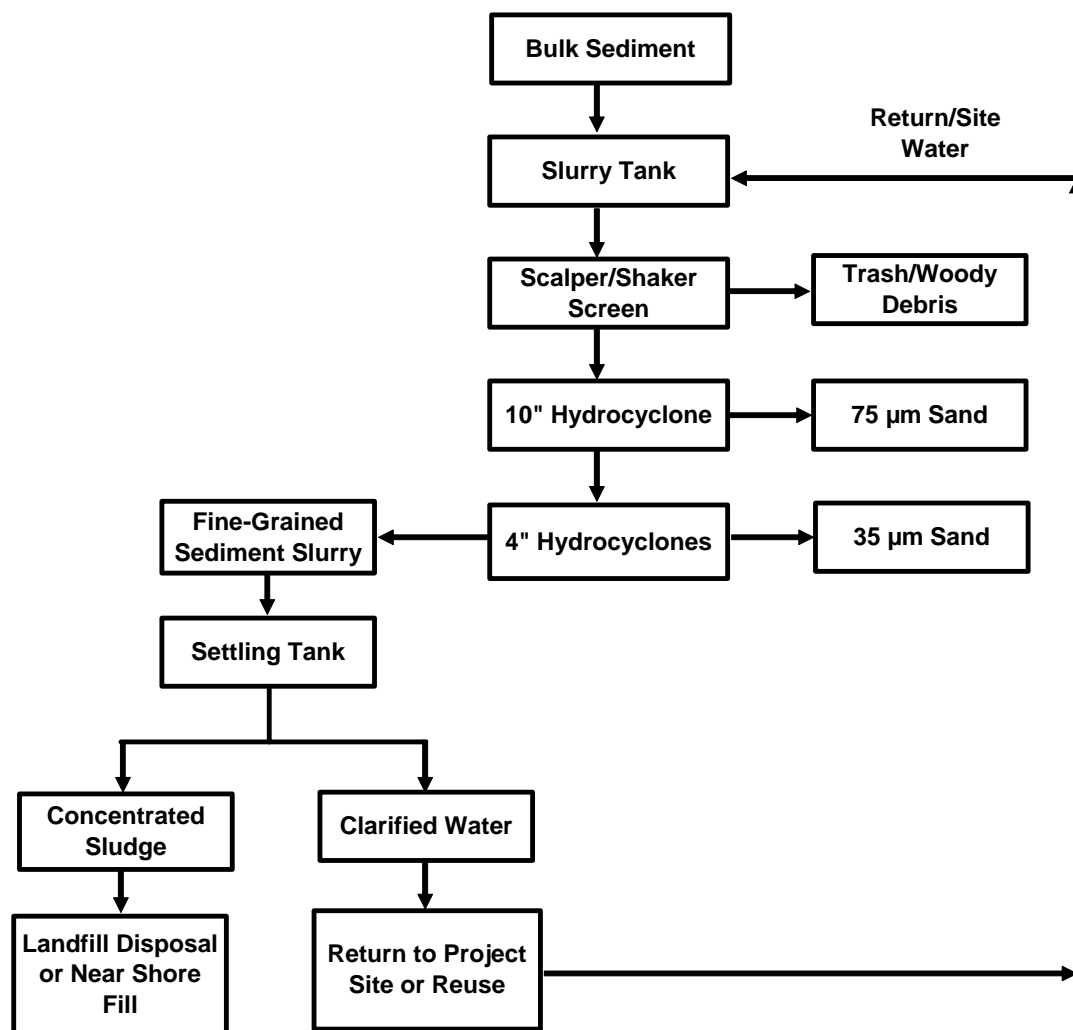


Figure 2.1 Hydrocyclone Field Pilot Study Treatment Design

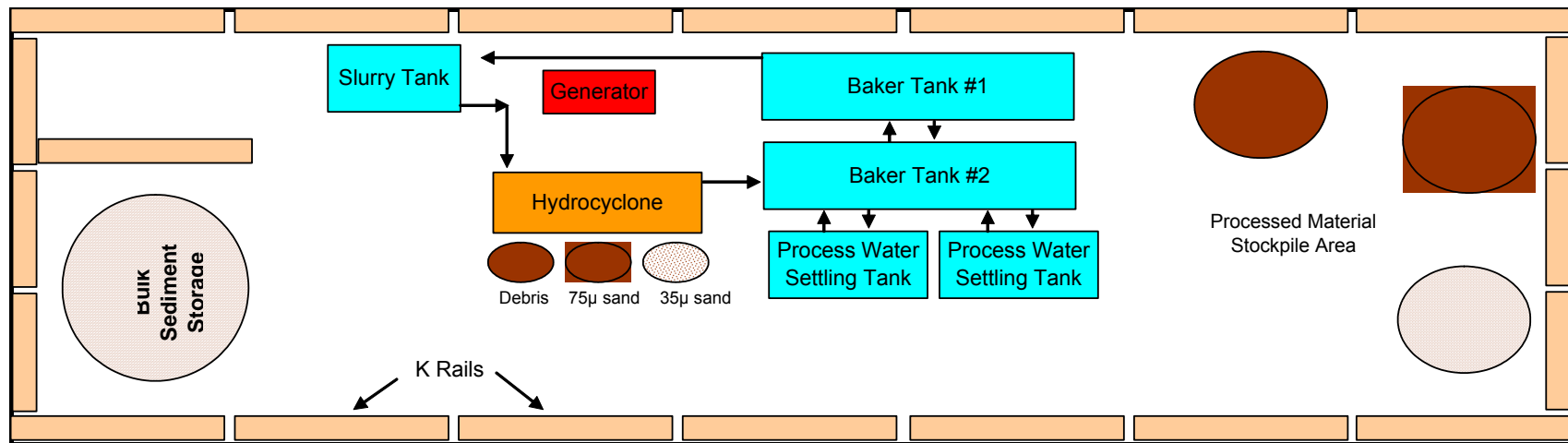


Figure 2.2 LARE Hydrocyclone Field Pilot Study Barge Layout



**Figure 2.3 Field Pilot Study Barge Layout**  
(Treatment equipment on left, derrick barge in middle and dredge material on right)



**Figure 2.4 Field Pilot Study – Manson Work Barge and Dredge Material**





**Figure 2.5** Aerial view of Tri-Flo International Hydrocyclone and Scalper Unit



**Figure 2.6** Aerial View of Hydrocyclone, Baker Tanks, Settling Tanks and Generator





**Figure 2.7** Field Pilot Study – Hydrocyclone in Operation.



**Figure 2.8** LARE Debris Removed from Scalper Unit



**Figure 2.9 Field Pilot Study – Washed Sand Output from 10” Hydrocyclone**



**Figure 2.10 Washed Sand after 24, 48, and 96 Hour Post Processing (right to left)**



## **2.3 PILOT TEST RESULTS**

### **Sand Separation Test Results**

Chemical results for the bulk sediment and processed sand are summarized, by day, in Table 2.1 and presented graphically in Figures 2.11 through 2.16. Sample designations include “debris” for the organic matter and trash removed by the scalper; “CS” for coarse sand which consists of the cut material produced by the 10” hydrocyclone; and “FS” for the fine sand cut from the 4” hydrocyclones. Table 2.2 presents a log of all sediment samples collected during the study, along with a description of any treatment process modifications made prior to or after sample collection.

Figure 2.11 presents the inorganic results of six metals (mercury, copper, lead, cadmium, zinc and nickel) measured in milligrams/kilograms (mg/kg). Three samples are labeled as Bulk (Bulk Weight), CS (Coarse Sand), and FS (Fine Sand). Four samples were taken for the bulk weight, with the dark bar denoting the average concentration and six samples were taken for both the CS and FS over the 4 day duration of processing. Overall, CS and FS samples showed decreasing trends in inorganic concentrations from the bulk material suggesting that the process was effective in reducing metal concentrations.

For mercury, bulk sediment concentrations ranged from 0.01 to 0.17 mg/kg and averaged 0.09 mg/kg. With the exception of one CS sample, all post processed samples showed significant reductions after passing through the hydrocyclones. The CS samples were lower than the FS samples suggesting that some carry-over was occurring at a particle size fraction between 35 and 75 microns, the cut sizes for the 4” and 10” hydrocyclones, respectively. Similar results were observed for copper, lead, cadmium, nickel, and zinc. Occasional post-processed samples produced concentrations above that observed for the bulk samples which suggest variable concentrations and equipment efficiencies. In all cases, however, CS concentrations were lower than FS concentrations. As with the mercury results, this suggests that some carry-over is occurring between the 35 and 75 micron particle size.

Figure 2.12 presents the sand separation organic results for Total PAHs, Total DDTs, and PCB’s measured in micrograms per kilograms (ug/kg). As with the inorganics, four samples were collected for bulk material chemistry, which includes a range of values and an average concentration denoted by the dark bar. Six separate post-processing samples were collected during the testing period for both coarse and fine grained, washed sand indicated in the graphs as CS and FS, respectively. Overall, the hydrocyclone separation process was much more efficient at removing PCB contaminants than was observed with the metals. However, PAHs and DDT showed similar results in that the CS samples were lower than the FS results indicating that some carry-over was also detected.

**Table 2.2 Field Pilot Study – Sediment Sample Log**

SAMPLE DATE	SAMPLE ID	SAMPLE DESCRIPTION
7-8-05	7-8-D-1	Debris sample from #30/40 mesh scalper screen.
7-8-05	7-8-CS-1	75µ coarse sand, collected at 1300 hrs
7-8-05	7-8-FS-1	35µ fine sand, collected at 1300 hrs
7-8-05	7-8-CS-2	75µ coarse sand, collected at 1500 hrs
7-8-05	7-8-FS-2	35µ fine sand, collected at 1500 hrs
<i>Production Note – Changed scalper screen to larger #20 mesh due to high sand content in debris</i>		
7-9-05	7-9-sludge-1	Sludge collected from bottom of settling tank
7-9-05	7-9-CS-1	75µ coarse sand, collected at 1300 hrs
7-9-05	7-9-FS-1	35µ fine sand, collected at 1300 hrs
7-11-05	7-11-CS-1	75µ coarse sand, collected at 1300 hrs
7-11-05	7-11-FS-1	35µ fine sand, collected at 1300 hrs
7-11-05	7-11-CSW-1	75µ coarse sand, collected at 1300 hrs, <b>hand washed*</b>
7-11-05	7-11-FSW-1	35µ fine sand, collected at 1300 hrs, <b>hand washed*</b>
7-12-05	7-12-CS-1	75µ coarse sand, collected at 1300 hrs
7-12-05	7-12-FS-1	35µ fine sand, collected at 1300 hrs
7-12-05	7-12-CSW-1	75µ coarse sand, collected at 1300 hrs, <b>spray washed**</b>
7-12-05	7-12-FSW-1	35µ fine sand, collected at 1300 hrs, <b>spray washed**</b>
7-12-05	7-12-solids-1	Slurry collected at 1400 hrs prior to scalper
7-12-05	7-12-solids-2	Slurry collected at 1430 hrs with attempt at higher solids
7-13-05	7-13-CS-1	75µ coarse sand, collected at 1300 hrs
7-13-05	7-13-FS-1	35µ fine sand, collected at 1300 hrs

\* Hand washing consisted of filling the sample jar with site water and sand, shaking it vigorously for 10 seconds, and then decanting the suspended material in the overlying water. This process was repeated 2 additional times and then a sample was collected.

\*\* Spray washing consisted of adding a garden hose with spray nozzle over the shaker screen leaving the 10" hydrocyclone and rinsing the material as it passes by.

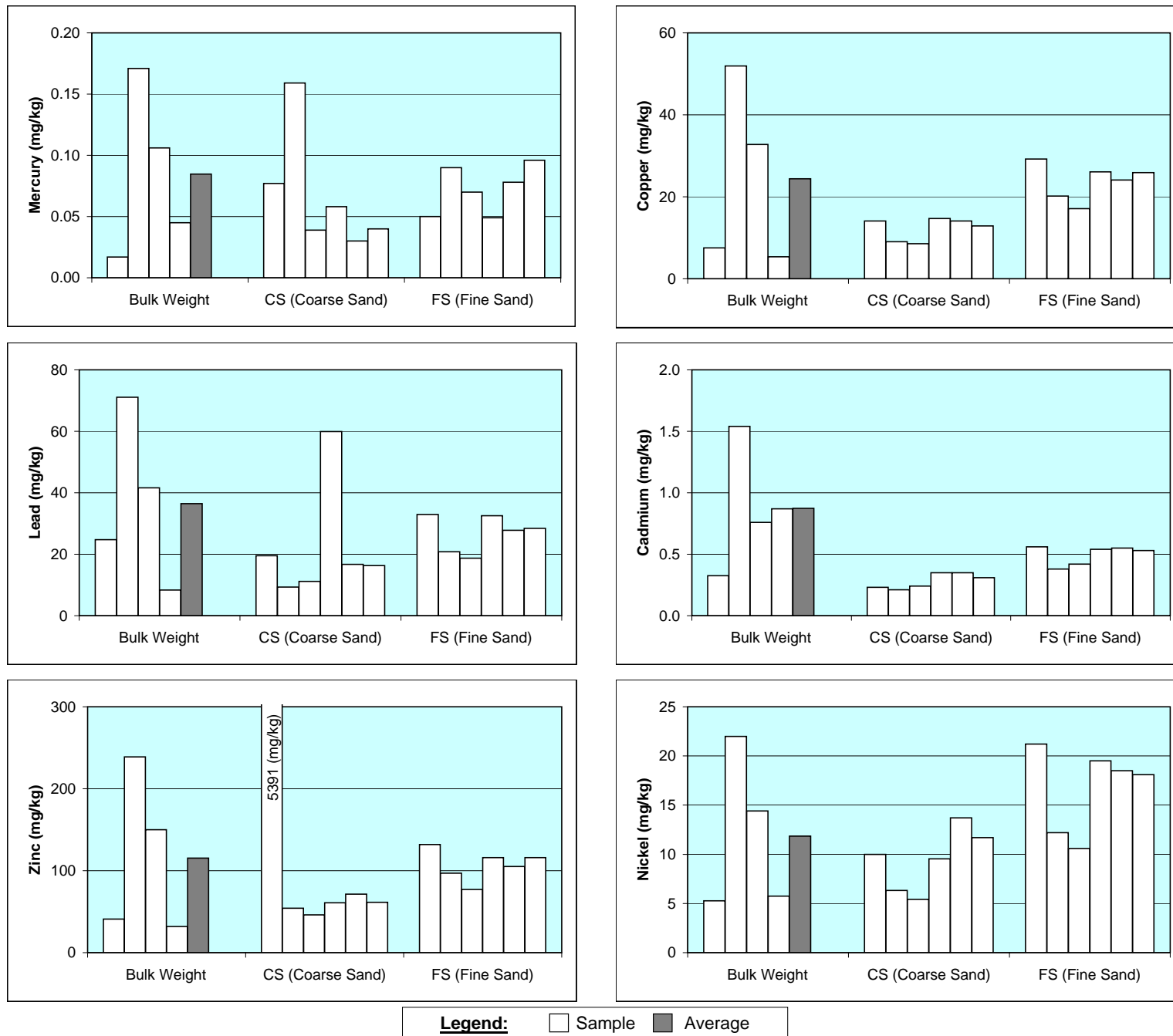
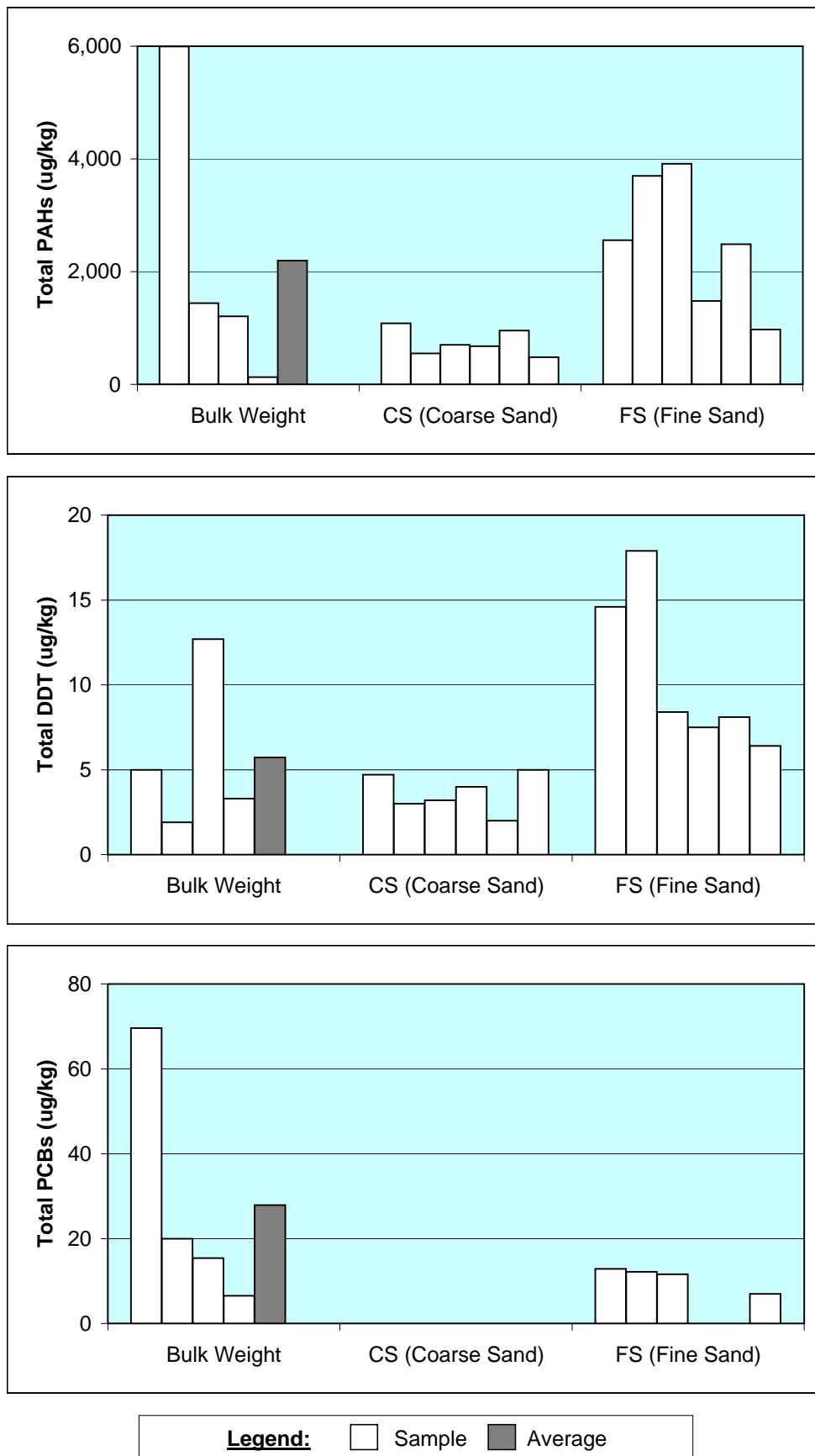


Figure 2.11 Sand Separation Results for Metals



**Figure 2.12 Sand Separation Results for Organics**

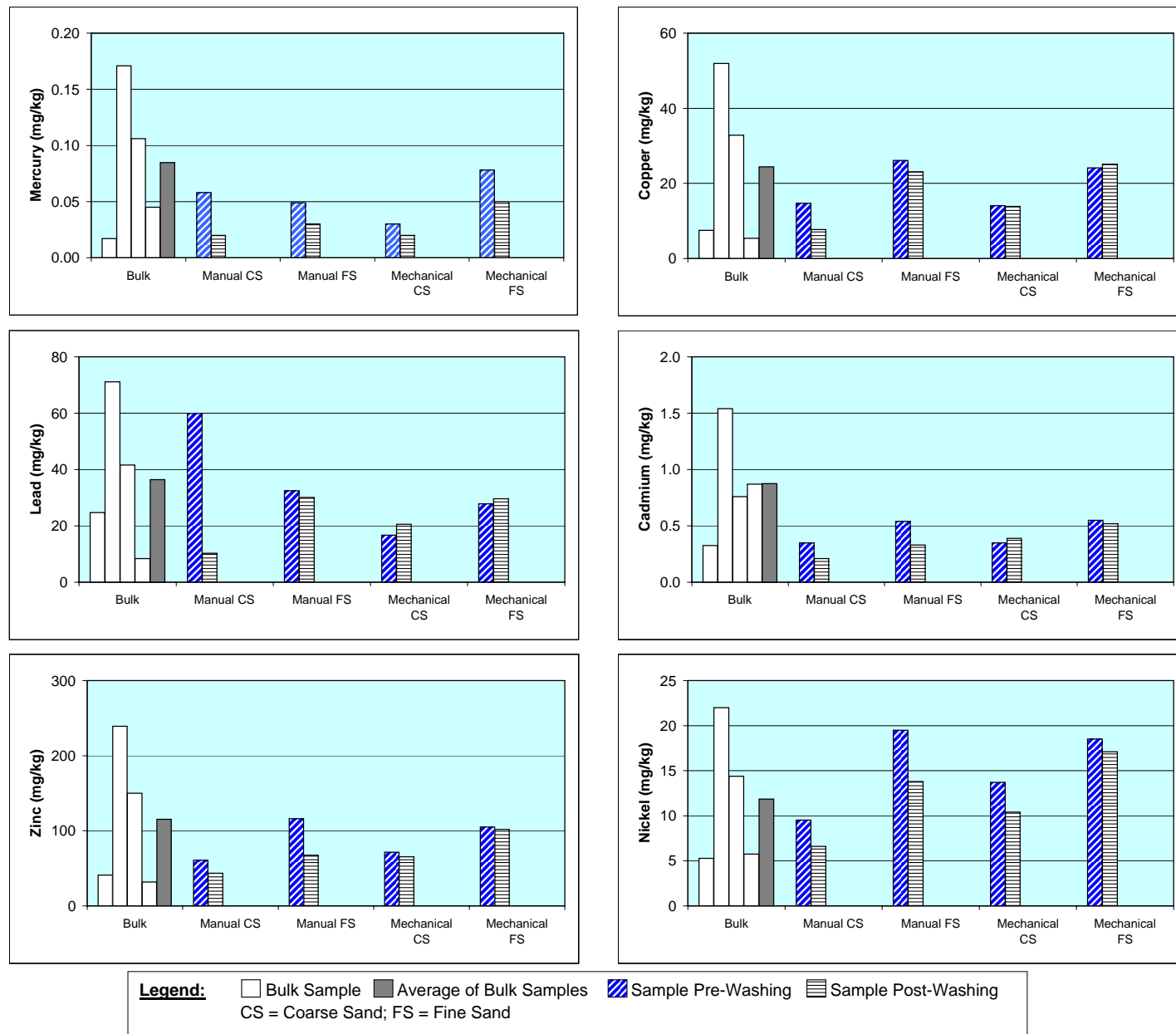


Figure 2.13 Washing Experiment Results for Metals

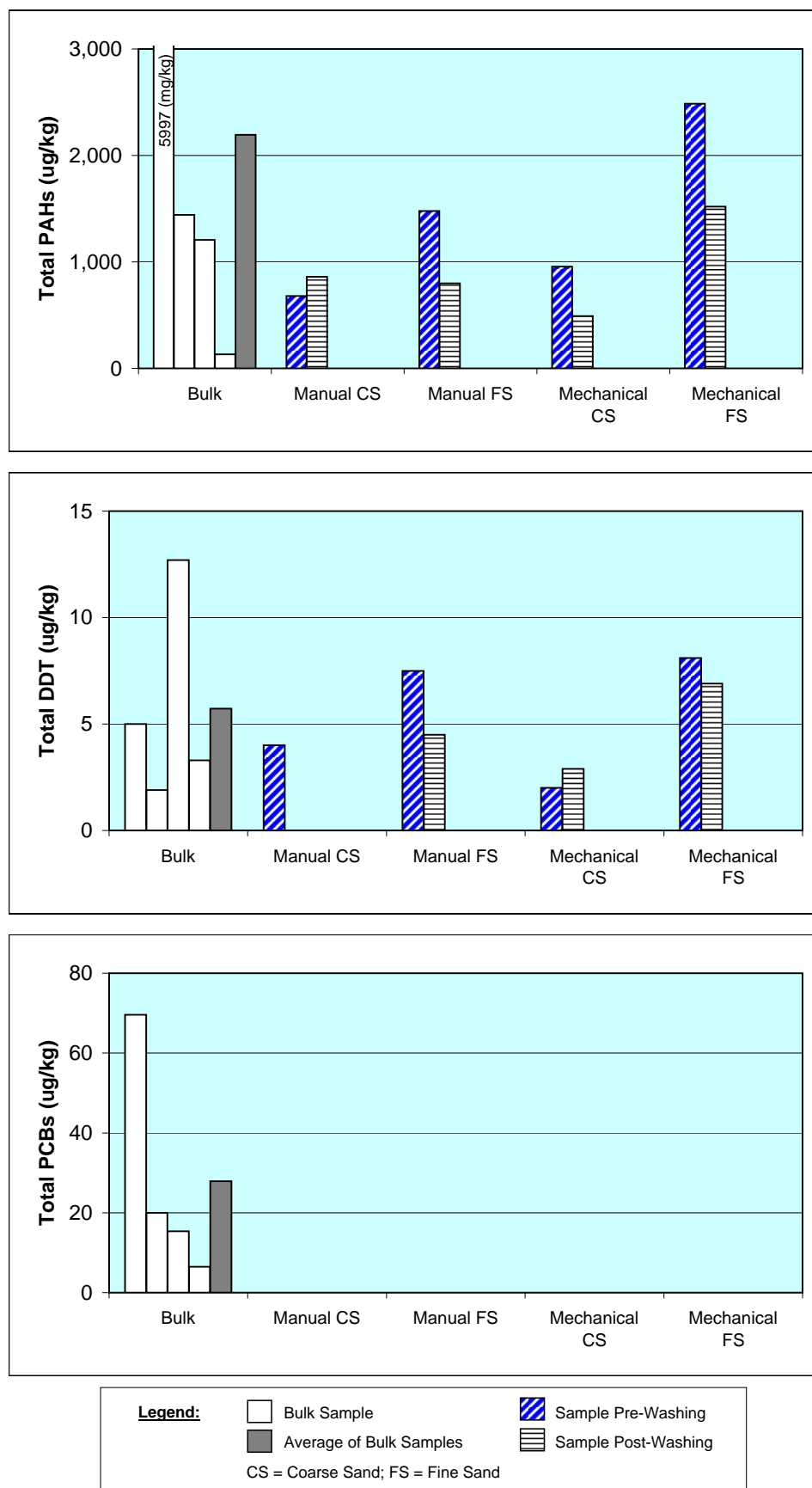


Figure 2.14 Washing Experiment Results for Organics



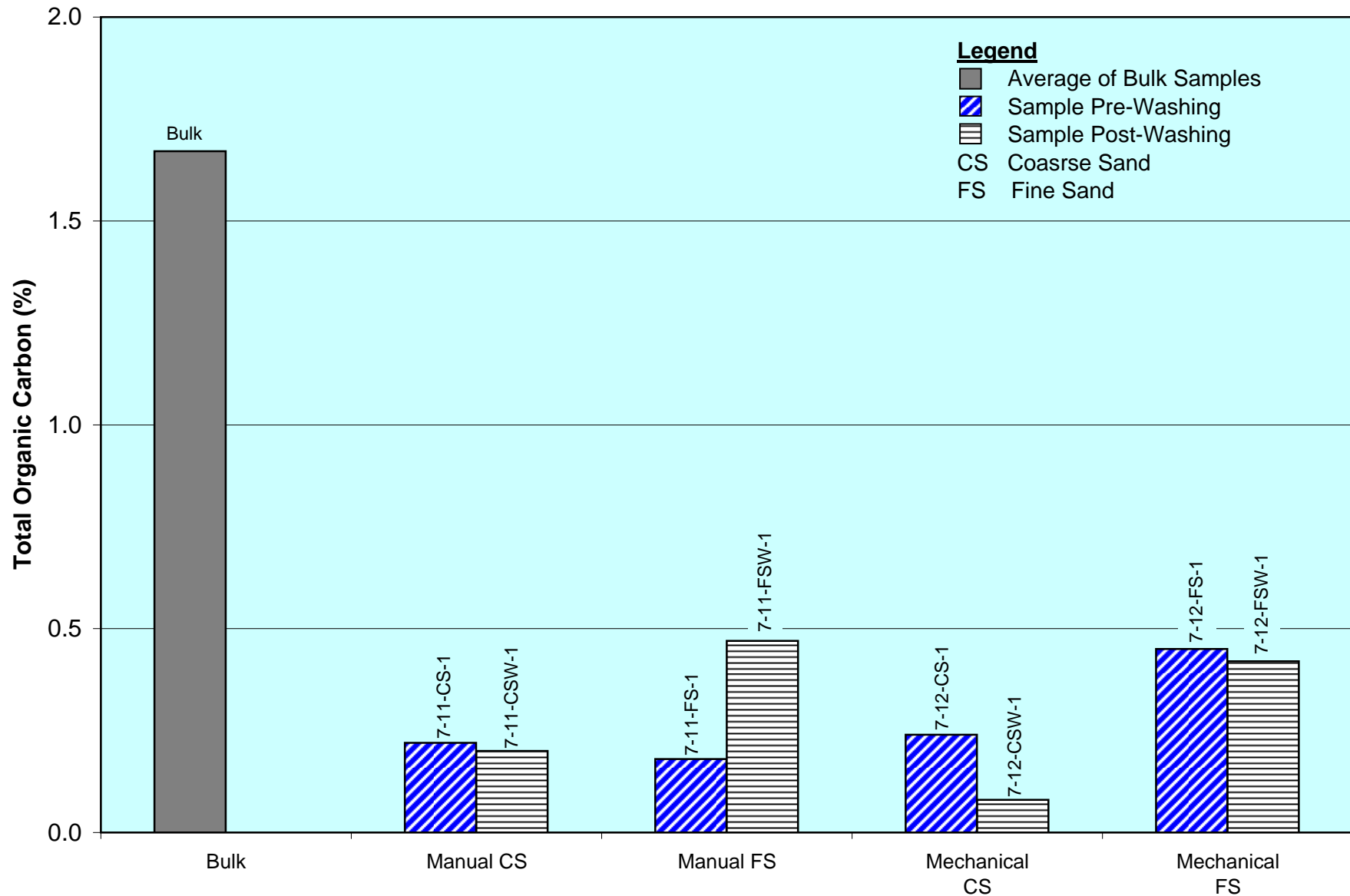
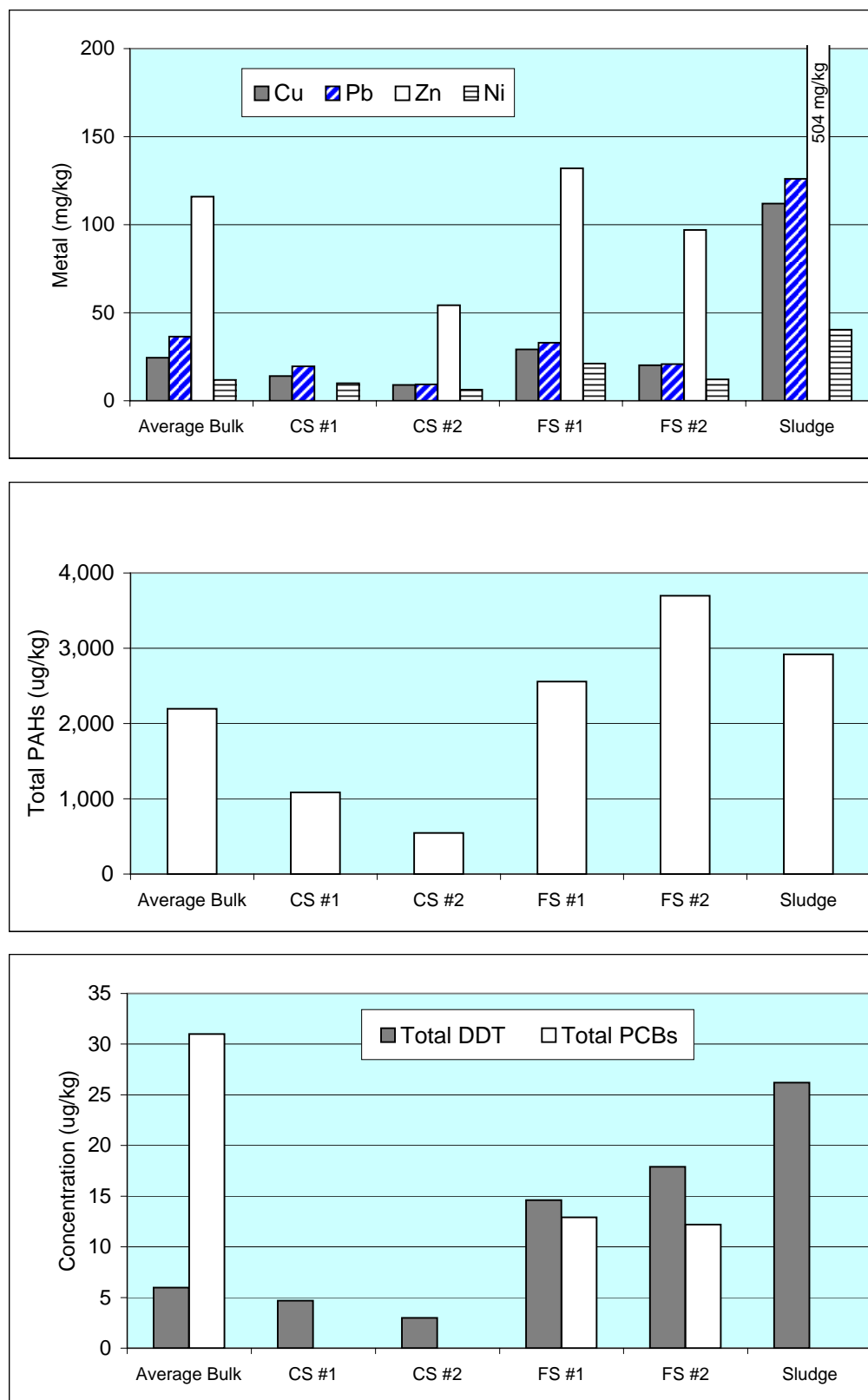


Figure 2.15 Washing Experiment Results for Total Organic Carbon



**Note:** CS = Coarse Sand; FS = Fine Sand

**Figure 2.16 Sludge Concentration Comparisons**

To evaluate the effectiveness of adding a washing process after the hydrocyclones as a way to increase the efficiency of removing the finer particle containing residual contamination, a series of tests were conducted using two approaches. The first approach consisted of simply adding the post processed sand (both CS and FS) to a sample jar containing site water and shaking it vigorously to create a slurry. The material was then allowed to settle and the fine grained material was decanted and discarded. This process was repeated two more times and the remaining “washed” sand was submitted for testing (labeled as “Manual”). The second approach consisted of using a garden hose with a spray nozzle to pump site water over the material (both CS and FS) as it exited the hydrocyclone to help strip fine-grained particles that may have carried over in the process. These post processed samples were also submitted for chemical analyses and labeled as “Mechanical”.

Figure 2.13 presents the results of the washing experiments. The results for six metals (mercury, copper, lead, cadmium, zinc, and nickel) are presented for both manual and mechanical washing. Bulk sediment concentrations represent test material before entering the hydrocyclones. For the washed material, pre-wash samples represent the material concentrations after the hydrocyclones but prior to washing and post-wash samples represent the post-washing concentrations. As a general trend, both washing approaches resulted in decreased metal concentrations. Overall, mercury had the highest concentration reduction on a percentage basis and the manual washing approach appeared to show a greater reduction than the mechanical washing approach.

Figure 2.14 presents the washing experiment results for Total PAHs, Total DDT and PCB's. As expected, total PAH, total DDT, and total PCB's concentrations were highest in bulk sediment concentrations, followed by the pre and then the post washing tests for the CS and FS samples. One sample from Mechanical FS exceeded 2000 ug/kg for Total PAH's. Overall, PAHs and DDTs showed greater concentration reductions than were observed with the metals. Total PCBs were eliminated after passing through only the hydrocyclones so the washing tests were not needed.

Figure 2.15 presents the Total Organic Carbon (TOC) results for the washing experiment. TOC is measured in percentage with nine samples including bulk weight (bulk), coarse sand (7-11 CS, 7-12-CS), coarse sand washed (7-11-CSW, 7-12-CSW), fine sand (7-11-FS, 7-12-FS), fine sand washed (7-11-FSW, 7-12-FSW). The bulk weight had the highest concentration of the nine samples taken at just above 1.5 percent. The other eight samples had TOC concentrations of less than 0.5 percent.

Chemical concentrations for the sludge material (fines output from the hydrocyclones), after settling in the Baker tanks, are presented in Figure 2.16. Four metals (Copper, Lead, Zinc, and Nickel), total PAH, DDTs and PCBs are presented for the bulk, CS, FS, and sludge material for sediments processed on the same day. As expected, sludge samples contained the highest chemical concentrations for both the metals and organics.

### **Process Water Test Results**

Process water used for the pilot study was initially collected via submerged pipe from the LARE next to the work barge housing the hydrocyclones. Water was pumped into the slurry tank and combined with the sediment to create a mixture containing approximately 10% solids before transferring it into the scalper unit. After sand removal, the resulting fine-grained sediment slurry was re-circulated back to the mixing tank and reused to mix with additional bulk sediments. This process was repeated until the water became super-saturated with fines at which time it was pumped into settling tanks and new seawater was collected to restart the process. Each batch of water was then allowed to settle until the overlying water was clear before returning it to the LARE (decant only). The settled solids were collected and disposed of at the Port of Los Angeles.

Prior to discharge, the settled water was tested for suspended solids and total recoverable chemical concentrations (metals, PAHs, pesticides and PCBs). Test results were then compared to initial process water chemistry concentrations as well as EPA Ambient Water Quality Criteria (Table 2.3) to evaluate for potential water quality impacts and need for further treatment. Analytical results are presented for two test scenarios. One test scenario included collecting the water immediately after leaving the hydrocyclone (i.e., no settling), and again after filtering through 1 and 50 $\mu$  bag filters. The second test included allowing the same water as used in test #1 to settle for approximately 15 hours, collecting the overlying water and then passing it through 1 and 50 $\mu$  bag filters to simulate additional treatment. Table 2.4 contains a log of all water samples collected.

**Table 2.3 Water Data Summary (1 of 2)**

Sample ID Sample Date Sample Matrix	7-8-LARE RAW 7/8/2005 WO	7-8-Slurry 1 7/8/2005 WO	7-8-WBF1-50 7/8/2005 WO	7-8-WBF1-1 7/8/2005 WO	7-9-Slurry 1 7/9/2005 WO	7-9-WBF 1-50 7/9/2005 WO	7-9-WBF 1-1 7/9/2005 WO
Total Solids (%)	--	--	--	--	--	--	--
Total Solids (mg/l)	--	--	--	--	--	--	--
Total suspended solids (mg/l)	4	9480	5200	36	58	35.5	19.5
<b>Total Metals (µg/l)</b>							
Aluminum	21.4	114000	79500	764	1670	1150	681
Antimony	0.131	2.8	8.62	2.95	1.12	1.99	2.77
Arsenic	0.866	29.3	7.87	0.669	1.09	0.922	0.696
Barium	--	1280	1020	--	--	--	--
Beryllium	0.01 U	8.31	5.28	0.028	0.047	0.029	0.016
Cadmium	0.031	60.8	46.4	0.123	0.236	0.142	0.076
Chromium	0.295	349	237	2.01	4.23	2.75	1.54
Cobalt	0.01 U	29.1	0.12 J	1.51	2.42	2.14	1.81
Copper	1.79	1180	706	4.22	8.82	5.8	3.17
Iron	56.3	251000	162000	980	2650	1830	1130
Lead	0.207	1310	759	5.51	8.29	5.7	3.04
Manganese	20.8	3580	2290	279	214	197	166
Mercury	0.00401	2.35	1.38	0.01208	0.01 U	0.01 U	0.01 U
Molybdenum	10.9	42	47.3	41.3	42.6	44.1	44
Nickel	0.67	357	207	5.04	7.42	6.29	5.46
Selenium	0.06	0.5 U	0.5 U	0.015 U	0.126	0.108	0.059
Silver	0.01 U	3.45	2.73	0.01 U	0.01 U	0.01 U	0.01 U
Strontium	--	8950	8490	--	--	--	--
Thallium	0.005 J	2.85	2.52	0.01 U	0.015	0.01 J	0.005 J
Tin	0.007 J	17.9	13.9	0.116	0.225	0.156	0.091
Titanium	1.59	908	1950	63.9	136	92.1	51.8
Vanadium	2.19	482	307	4.39	8.11	5.56	3.63
Zinc	8.99	5600	3240	23.1	35.4	24	13.7
<b>SVOCs (ng/l)</b>							
1,1'-Biphenyl	5 U	571	227	35.5	1.9 J	5 U	5 U
1-Methylnaphthalene	5 U	850	352	211	1.2 J	5 U	5 U
1-Methylphenanthrene	5 U	1080	577	5 U	18.9	5 U	5 U
2,3,5-Trimethylnaphthalene	5 U	1330	588	30.6	21.2	5 U	5 U
2,6-Dimethylnaphthalene	5 U	3090	1280	84.9	25.1	10.7	8.4
2-Methylnaphthalene	5 U	1320	547	213	7.5	3 J	3.7 J
Acenaphthene	5 U	300	136	21.5	10.2	5 U	5 U
Acenaphthylene	5 U	105	44	5 U	4 J	4.2 J	5 U
Anthracene	5 U	832	312	5 U	21.4	6.3	5 U
Benzo(a)anthracene	5 U	2080	900	5 U	52.5	7.2	5 U
Benzo(a)pyrene	5 U	2100	825	5 U	46.9	11.7	5 U
Benzo(b)fluoranthene	5 U	2410	979	5 U	49.2	11.3	5 U
Benzo(e)pyrene	5 U	2440	984	5 U	46.7	12.4	5 U
Benzo(g,h,i)perylene	5 U	2260	1120	5 U	40.1	12.1	40.1
Benzo(k)fluoranthene	5 U	2060	769	5 U	44.3	11.2	5 U
Chrysene	5 U	4240	1640	5 U	92.6	21.6	5 U
Dibenzo(a,h)anthracene	5 U	337	168	5 U	6.6	5 U	6.6
Dibenzothiophene	--	--	--	--	5 U	5 U	5 U
Fluoranthene	5 U	6680	2580	5 U	132	46.4	18.6
Fluorene	5 U	782	324	27.6	12.4	5 U	5 U
Indeno(1,2,3-cd)pyrene	5 U	1440	658	5 U	36.7	7.6	36.7
Naphthalene	5 U	409	167	90.4	5 U	5 U	5 U
Perylene	5 U	1110	485	5 U	17.4	6	5 U
Phenanthrene	5 U	4850	1810	5 U	59.7	16.5	5.5
Pyrene	5 U	7410	2840	5 U	137	48.4	18.9
Total PAHs (U=0)	0	50086	20312	714.5	885.5	236.6	138.5
<b>Pesticides (ng/l)</b>							
2,4'-DDD	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,4'-DDE	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2,4'-DDT	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4,4'-DDD	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4,4'-DDE	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4,4'-DDT	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Total DDT (U=0)	0	0	0	0	0	0	0
Aldrin	5 U	5 U	5 U	5 U	5 U	5 U	5 U
alpha-BHC	5 U	5 U	5 U	5 U	5 U	5 U	5 U
alpha-Chlordane	5 U	77.3	48.3	5 U	5 U	5 U	5 U
beta-BHC	5 U	5 U	5 U	5 U	5 U	5 U	5 U
delta-BHC	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dieldrin	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Endosulfan I	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Endosulfan II	5 U	5 U	5 U	5 U	5 U	5 U	5 U

**Table 2.3 Water Data Summary (2 of 2)**

Sample ID Sample Date Sample Matrix	7-8-LARE RAW 7/8/2005 WO	7-8-Slurry 1 7/8/2005 WO	7-8-WBF1-50 7/8/2005 WO	7-8-WBF1-1 7/8/2005 WO	7-9-Slurry 1 7/9/2005 WO	7-9-WBF 1-50 7/9/2005 WO	7-9-WBF 1-1 7/9/2005 WO
Pesticides (ng/l) (Continue from previous page)							
Endosulfan sulfate	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Endrin	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Endrin aldehyde	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Endrin ketone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
gamma-BHC (Lindane)	5 U	5 U	5 U	5 U	5 U	5 U	5 U
gamma-Chlordane	5 U	116	43.8	5 U	5 U	5 U	5 U
Heptachlor	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Heptachlor epoxide	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methoxychlor	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Mirex	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Oxychlordane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toxaphene	50 U	50 U	50 U	50 U	50 U	50 U	50 U
trans-Nonachlor	5 U	71.7	27	5 U	5 U	5 U	5 U
<b>PCBs (ng/l)</b>							
Aroclor 1016	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Aroclor 1221	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Aroclor 1232	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Aroclor 1242	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Aroclor 1248	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Aroclor 1254	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Aroclor 1260	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Total PCBs (U=0)	0	0	0	0	0	0	0
<b>PCB Cong (ng/l)</b>							
PCB-18	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-28	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-31	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-33	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-37	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-44	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-49	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-52	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-66	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-70	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-74	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-77	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-81	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-87	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-95	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-97	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-99	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-101	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-105	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-110	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-114	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-118	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-119	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-123	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-126	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-128/167	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-132/168	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-138	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-141	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-149	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-151	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-153	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-156	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-157	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-158	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-169	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-170	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-177	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-180	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-183	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-187	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-189	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-194	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-200	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-201	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB-206	5 U	5 U	5 U	5 U	5 U	5 U	5 U

**Table 2.4 Field Pilot Study – Process Water Sample Log**

SAMPLE DATE	SAMPLE ID	SAMPLE DESCRIPTION
7-8-05	7-8-LARE-RAW	Raw site water collected from the LARE at 1300 hrs
7-8-05	7-8-WBF1-1	Unsettled slurry water after 1μ bag filter at 1400 hrs
7-8-05	7-8-WBF1-50	Unsettled slurry water after 50μ bag filter at 1400 hrs
7-8-05	7-8-Slurry-1	Unsettled slurry water at 1400 hrs.
7-9-05	7-9-WBF1-1	Settled slurry water after 1μ bag filter at 1200 hrs
7-9-05	7-9-WBF1-50	Settled slurry water after 50μ bag filter at 1200 hrs
7-9-05	7-9-Slurry-1	Settled slurry water after 15hrs – no filtration – collected at 1200 hrs

Test results showed that the unsettled water (discharge slurry from the hydrocyclones) contained very high particulate loads and chemical concentrations. The bag filters were quickly overloaded and considerable chemicals of concern were able to pass through the filter media and render them ineffective. Allowing the water to settle overnight, however, resulted in a dramatic improvement in water quality. Both suspended solids and chemical concentrations were much lower in the unfiltered water, but still 2 to 3 times higher than the initial water collected from the LARE. Passing the water through the bag filters also resulted in additional improvements. The water passing through the 1μ filter produced water very similar to the site water and significantly below EPA's discharge criteria for instantaneous releases.

These results suggest that simply allowing the water to settle before discharge may be sufficient for water quality compliance. If it is not, adding some form of mechanical filtration system like adding bag filters can be a very effective solution.

## 2.4 PRODUCTION RATES AND COSTS

Production rates for the field pilot study were kept at a minimum because the primary goal for the study was to determine treatment effectiveness and potential for use in a regional treatment facility. Although the Tri-Flo International equipment can include the use of two 10" hydrocyclones, only one was tested for the pilot study. Table 2 -5 presents a summary of the production rates observed for the pilot study vs. that which the equipment is conservatively capable of producing.

**Table 2.5 Pilot Study Equipment Comparison to Equipment Capacity**

LARE FIELD PILOT STUDY	TRI-FLO EQUIPMENT CAPACITY
1-10" hydrocyclone and 8-4" hydrocyclones/unit	2-10" hydrocyclones and 8-4" hydrocyclones/unit
500 gal/min	1000 gal/min
~10% solids	~15% solids
6 yards/hour (bulk)	22-30 yards/hour (bulk)
20 hrs/day = 120 yards/day	20 hrs/day = 440 - 600 yards/day

The information provided in Table 2.5 shows the throughput capacity of the equipment and not necessarily the actual production rates observed throughout the current study. Because the project goal was to validate the technology, several experimental adjustments were conducted during each day's operation that resulted in shutting down the equipment for modifications every few hours. The production rate presented in Table 2.5 for the pilot study (6 yards/hour) was a measured rate during a short period of optimal performance for the equipment on hand. Had all the proper equipment been available, the pilot study design should have been capable of processing approximately 12 yards/hour. The limiting factor in this design is the single 10" hydrocyclone. Thus, doubling the number of 10" cones should double the throughput of the system. In total, the pilot study processed a little over 100 cubic yards of material. Approximately 20% was large woody debris, 70% sand, and 10% fine grained silts and clays (deposited at the POLA at the conclusion of the project).

Field pilot study costs were not representative of future test scenarios for this technology because of the following:

- Not all the equipment that was obtained was needed resulting in significant excess mobilization and equipment rental costs; and
- Conducting the project on barges required significant additional effort mobilizing the equipment and transferring the bulk sediment from a storage barge to a work barge (required the use of a derrick barge for the entire study).

## 2.5 AREAS FOR IMPROVEMENT

During the hydrocyclone field pilot study, several problem areas were identified for future investigation and/or modification. Most significantly was the inefficiency of the system to



used in the pilot study was to dump the bulk sediment into a large mixing tank containing a high velocity re-circulating pump. On top of the tank was a mesh screen to catch the large debris prior to entering the mix tank. The difficulty with this approach was that the bulk sediment did not flow through the screen and had to be manually washed into the slurry tank. A vibrating concrete mixer was later added to provide a vibration source to further help the process. The net result was that slurry solids concentrations were below the target level for optimal use of the hydrocyclone. Future uses of this equipment should include either a hydraulically dredged source and/or a macerator system to grind up the debris as it is mixed with the dilution water. For hydraulically dredged material, a cutter head or suction dredge would need to be matched in size and capacity to pump directly into the hydrocyclone tanks.

An additional area for improvement is the addition of a wash system to the output screens for the hydrocyclones to further rinse fine-grained material that is not separated in the cones. The material leaving the 10" hydrocyclone still contained between 4 and 14% silts and clays carried over by the system. To provide an additional washing step, the use of seawater spray rinsing was evaluated and resulted in nearly complete removal of the silts and clays, and subsequently lower contaminant levels.

### **3. DEVELOPMENT OF A REGIONAL STAR FACILITY**

#### **3.1 SITE REQUIREMENTS**

Based on an initial evaluation of the dredging and disposal need for the LA Region, the following list of STAR facility location qualities has been developed:

- STAR facility must be in close relative proximity to the majority of the target dredge areas to minimize transport or pumping costs.
- STAR facility must allow for quick and easy transport of dredge materials to the facility, without impacting local infrastructure (roads) and air quality.
- STAR facility must allow for waste water elimination during dewatering step.
- STAR facility must be located in area that provides for easy transport of treated material to target markets (e.g., roadway developed for haul truck passage, railroad lines, waterfront access).
- STAR facility must not be located in area where high noise levels or potential offending odors resulting from organic-rich sediment will cause adverse impacts to nearby residences.
- STAR facility must be located in area not containing sensitive habitat or groundwater resources.
- STAR facility lease/purchase rates must be competitive to allow for cost effectiveness.
- STAR facility must contain sufficient space for storage of bulk sediment, treatment equipment, and final product storage.

#### **3.2 TREATMENT APPROACH & STAR FACILITY DESIGN**

Sediment processing at a regional STAR facility would likely consist of a series of mechanical and/or chemical systems to first extract potentially reusable material (e.g., sand) and then to treat the remaining material to render it inert for disposal or upland reuse applications. The specific design of the treatment system may vary depending on the physical characteristics of the material (i.e., sand content, presence of debris) and method for delivery to the site (i.e., hydraulically pumped vs. mechanical clamshell). Regardless of the specific equipment, the treatment process will likely include some common design

elements similar to those testing in the pilot study described in Section 2. Figures 3.1 and 3.2 provide example treatment scenarios for sediment processing considering hydraulic and mechanical dredging sources, respectively.

Both approaches include a mechanism for creating a sediment slurry of approximately 10-15% solids and then passing the material through screens and a macerator to remove large debris and grind up the smaller debris items. This material is then removed using a scalper so that the feedstock to the hydrocyclones is free of trash and debris. Next, a series of hydrocyclones can be used to separate the clean sand from the finer-grained, and more contaminated particles. The washed sand can then be exported as clean fill material or for beach nourishment. If needed, the residual slurry can be reused for suspending additional sediments, creating a closed treatment system or discharged to a settling tank to separate the fine grained particles from the overlying water.

Slurry water treatment will likely require a multi-step process that begins with gravity settling. This process may be aided by the addition of flocculants to the water to speed up the process. Once settling has occurred, the overlying water may or may not be suitable “as is” for discharge. If the water is determined not to be suitable, additional treatment steps may be needed such as media filters, carbon or resin beds, or the addition of chemicals to bind up and settle any remaining contaminants (e.g., EDTA for metals).

The fine-grained, contaminated, sludge remaining in the settling tanks would then be removed and dewatered for disposal. Active dewatering can be accomplished physically by using belt presses or centrifuges, or chemically using cement-based binders. Passive dewatering can be accomplished by simply allowing the material to air dry. Two advantages of using cement-based binders to dewater the sludge is that they will (1) bind up most of the contaminants in the process and allow the material to be disposed of more easily, and (2) the treated material will exhibit much greater geotechnical strength which could allow the material to be used as sub base fill material.

### **3.3 POTENTIAL STAR FACILITY LOCATIONS**

Taking into consideration the target site qualities discussed in Section 3.1, and meetings and discussions with the County of Los Angeles and the City of Long Beach, three potential STAR facility locations have been identified for the LA Region. These include one location at Marina del Rey and two locations within the City of Long Beach. The locations of these three potential sites are shown in Figure 3.3. A brief description for each of these three sites is provided here.

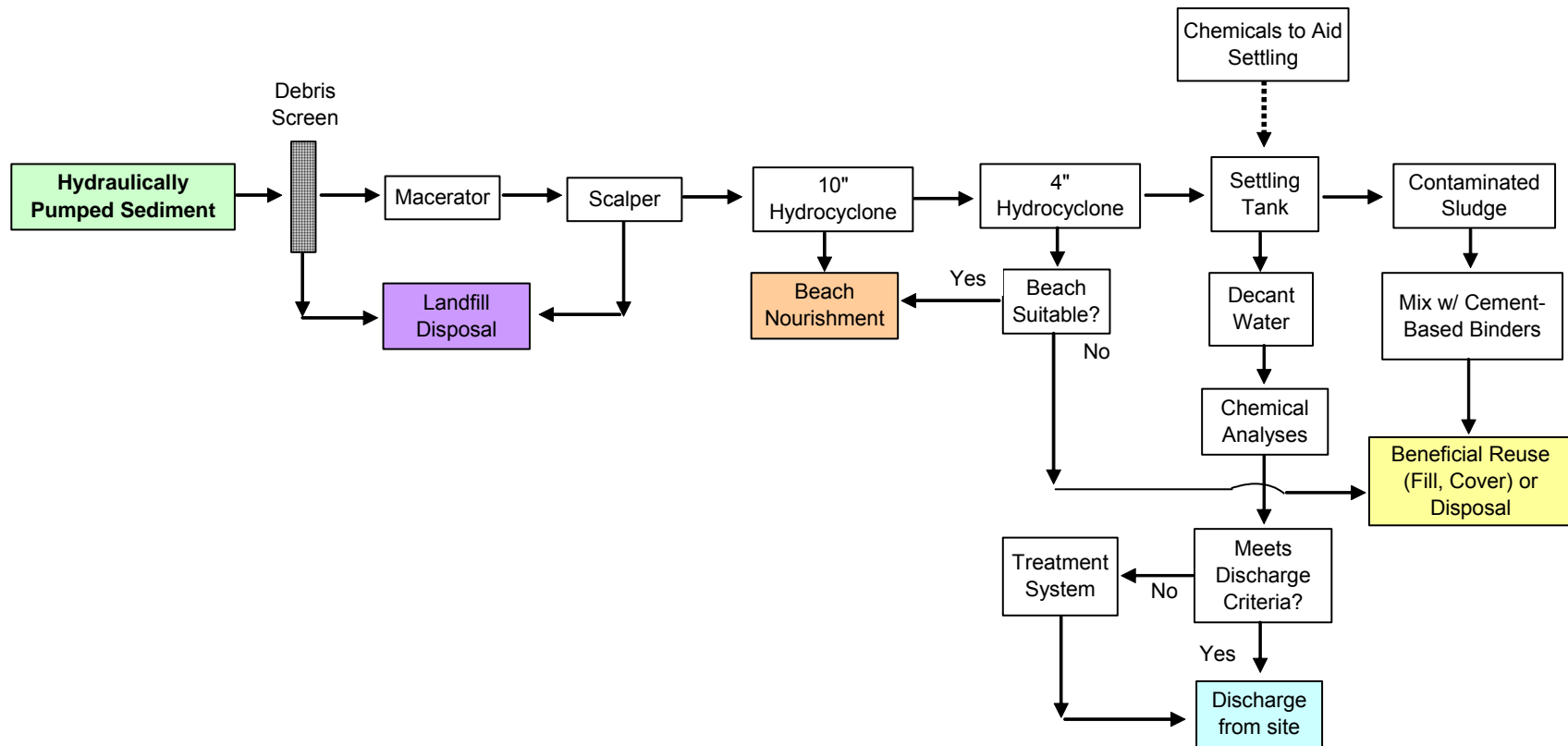


Figure 3.1 Sediment Treatment and Reuse Site Treatment Design Option #1 (Hydraulic Dredging)

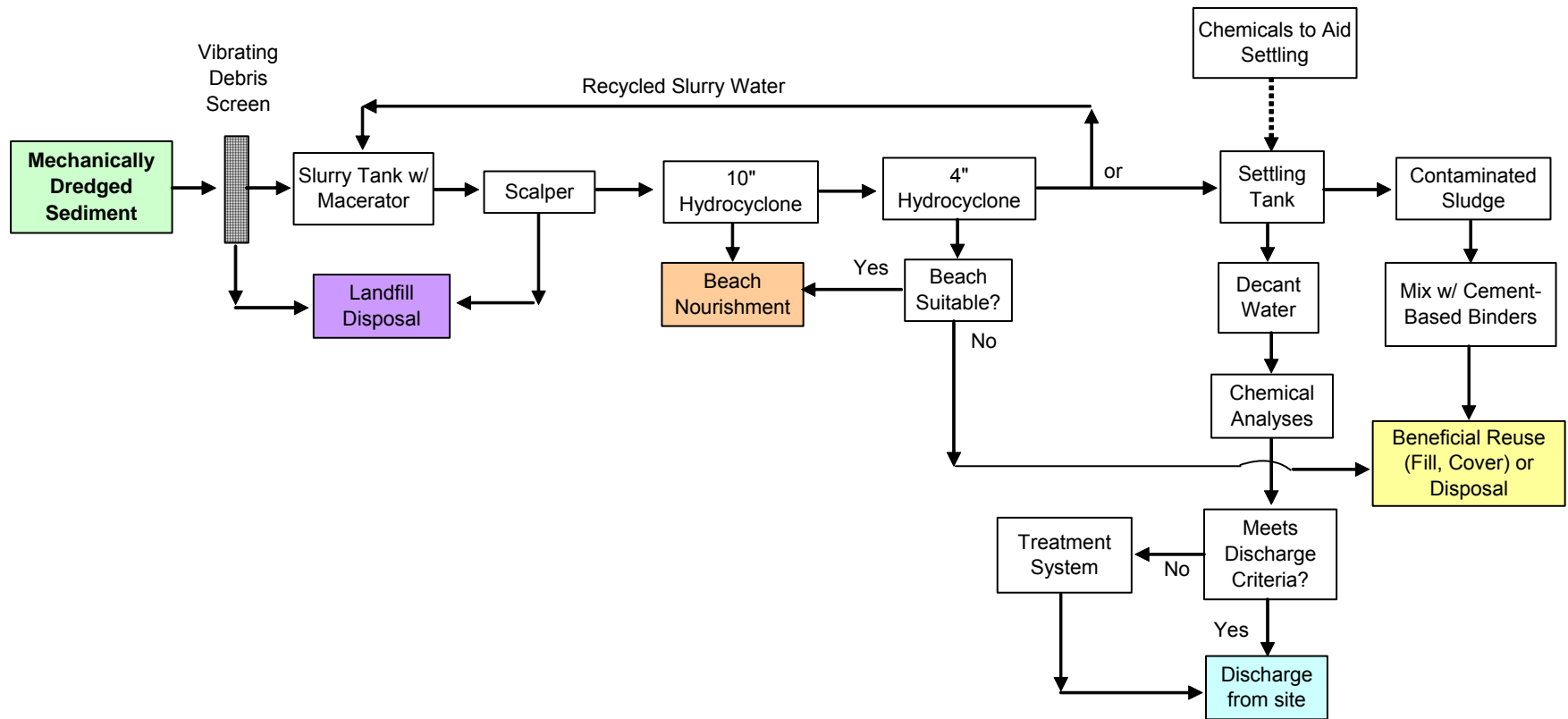


Figure 3.2 Sediment Treatment and Reuse Site Treatment Design Option #2 (Mechanical Dredging)



Figure 3.3 Potential Locations of STAR Facility Sites

### **Marina del Rey Site**

The County of Los Angeles has been considering creating a landfill behind the existing breakwater for the construction of a transient dock, a fish pen, a wharf and other facilities (Figure 3.4). This provides a great opportunity of constructing a STAR facility at this site since Marina del Rey Harbor entrance needs regular dredging to maintain safe navigation channels. The dredged material can be cost-effectively transported to the STAR facility for treatment and reprocessing. Figure 3.5 shows a conceptual design of laying out a STAR facility at this site

### **City of Long Beach Upland Location**

The City of Long Beach has identified a vacant lot along the east bank of the Los Angeles River just north of the Anaheim Street that may be suitable for the construction of a STAR facility. This location is two miles north of the Los Angeles River Estuary. Figure 3.6 shows a conceptual design for a STAR facility at this site.

### **City of Long Beach Shoreline Marina Location**

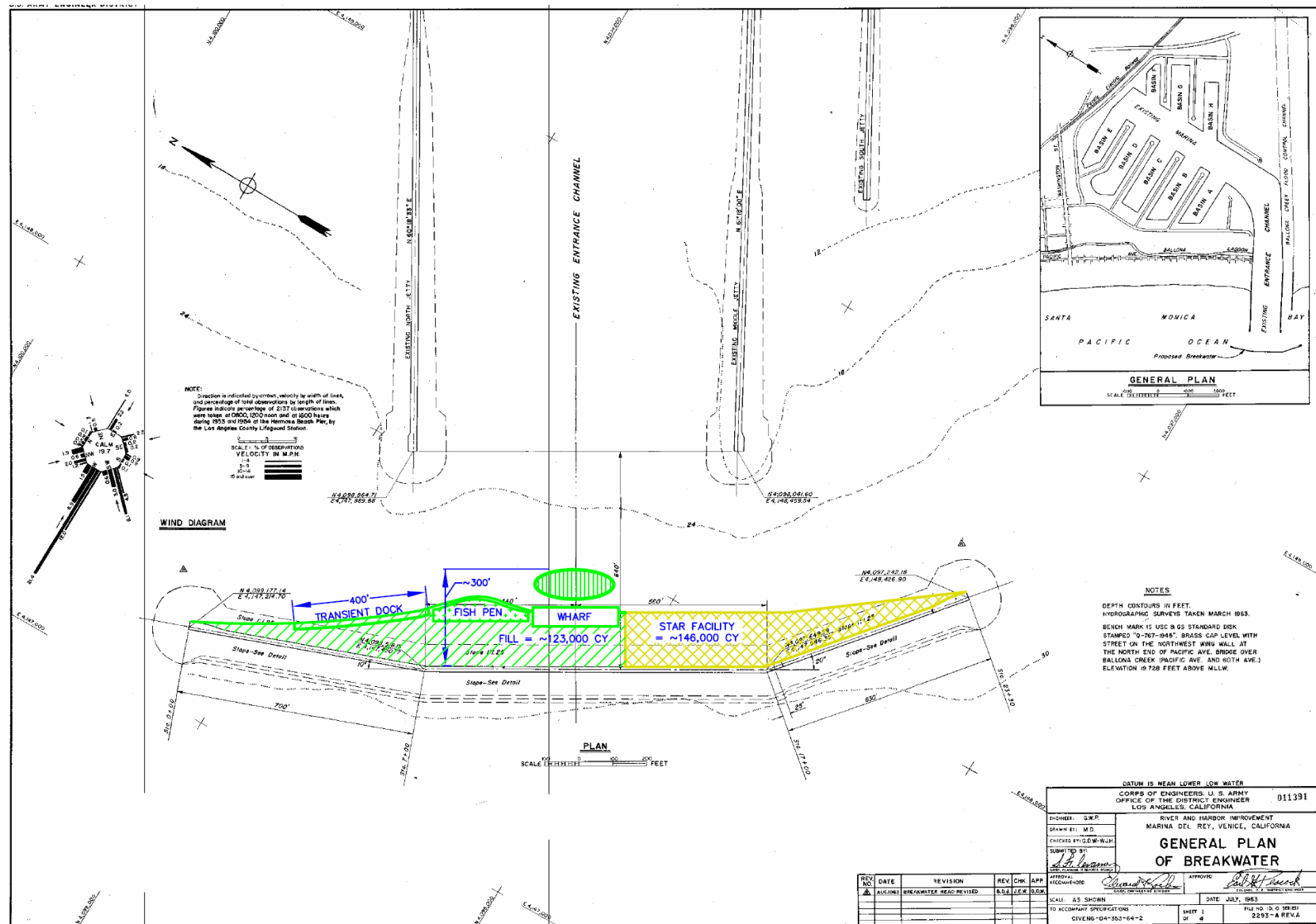
The City of Long Beach has expressed interest in the development of a Confined Disposal Facility (CDF) site near the Los Angeles River Estuary (LARE) next to the City Shoreline Marina. The location of this proposed CDF site is shown in Figure 3.7. This provides an opportunity to use portion of the CDF area for the construction of a STAR facility. Figure 3.8 shows a conceptual STAR facility layout using the west end of the CDF for the facility. Similar to the Marina del Rey site, this Long Beach site is close to the federal navigation channel, which needs regular dredging to maintain safe navigation. It will be cost-effective to deliver the LARE dredged material to the STAR facility for treatment and reprocessing.

Based on the criteria presented in Section 3.1, other potential upland locations for the STAR facility include:

- Other upland property located along the non-residential, lower portion of the Los Angeles River (LAR) where a pipeline could be used to transport the dredged materials further inland,
- Any of the four THUMS energy islands,
- Upland property located at the Seal Beach Naval Weapons Facility,
- Upland property located within the ports of Los Angeles or Long Beach.



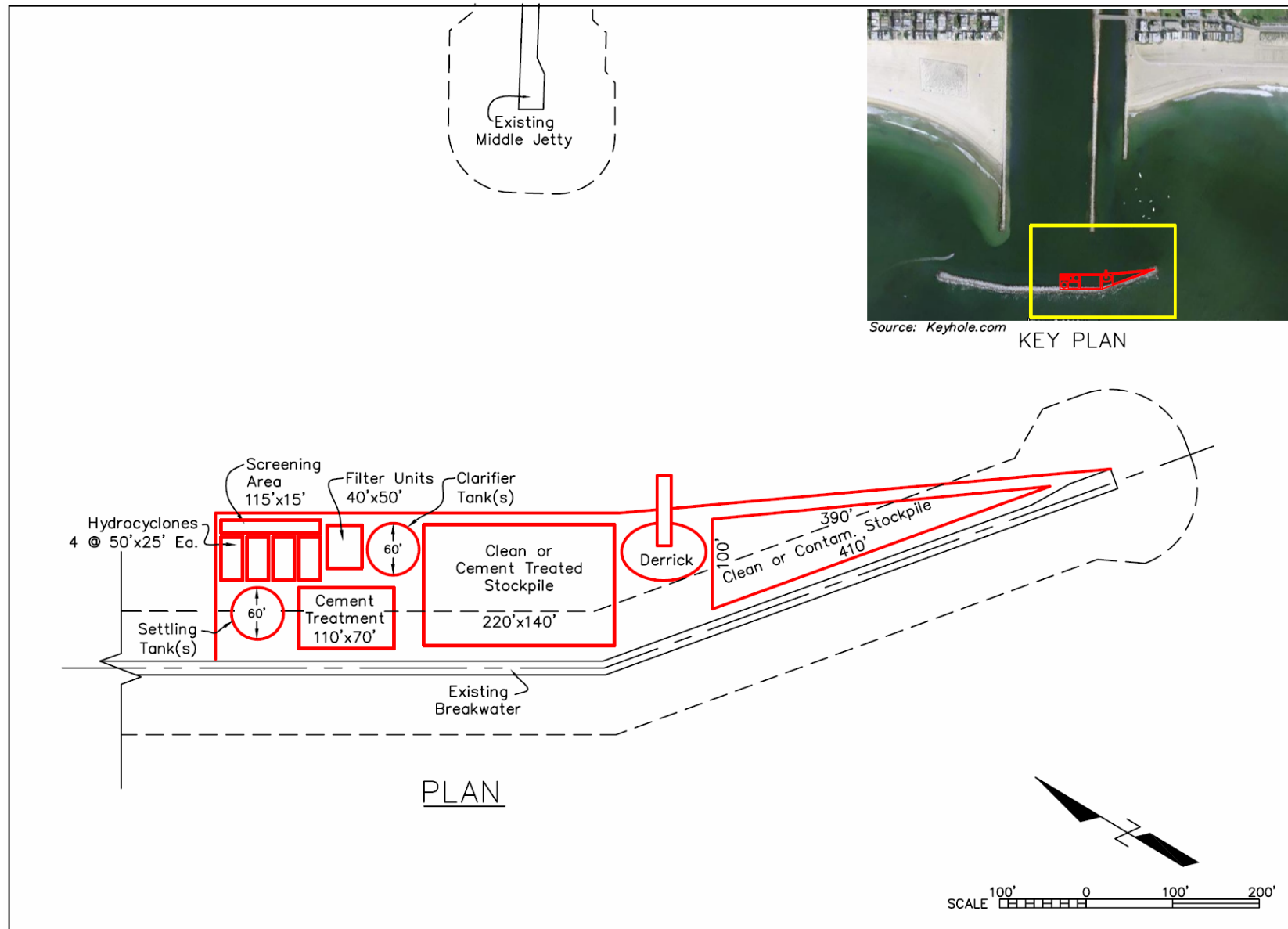
*Los Angeles Dredged Material Management Plan (DMMP)  
Development of a Regional Treatment Facility for Use in Southern California*



Source: Los Angeles County

**Figure 3.4 Proposed Marina del Rey Landfill**





**Figure 3.5 Marina del Rey Site**

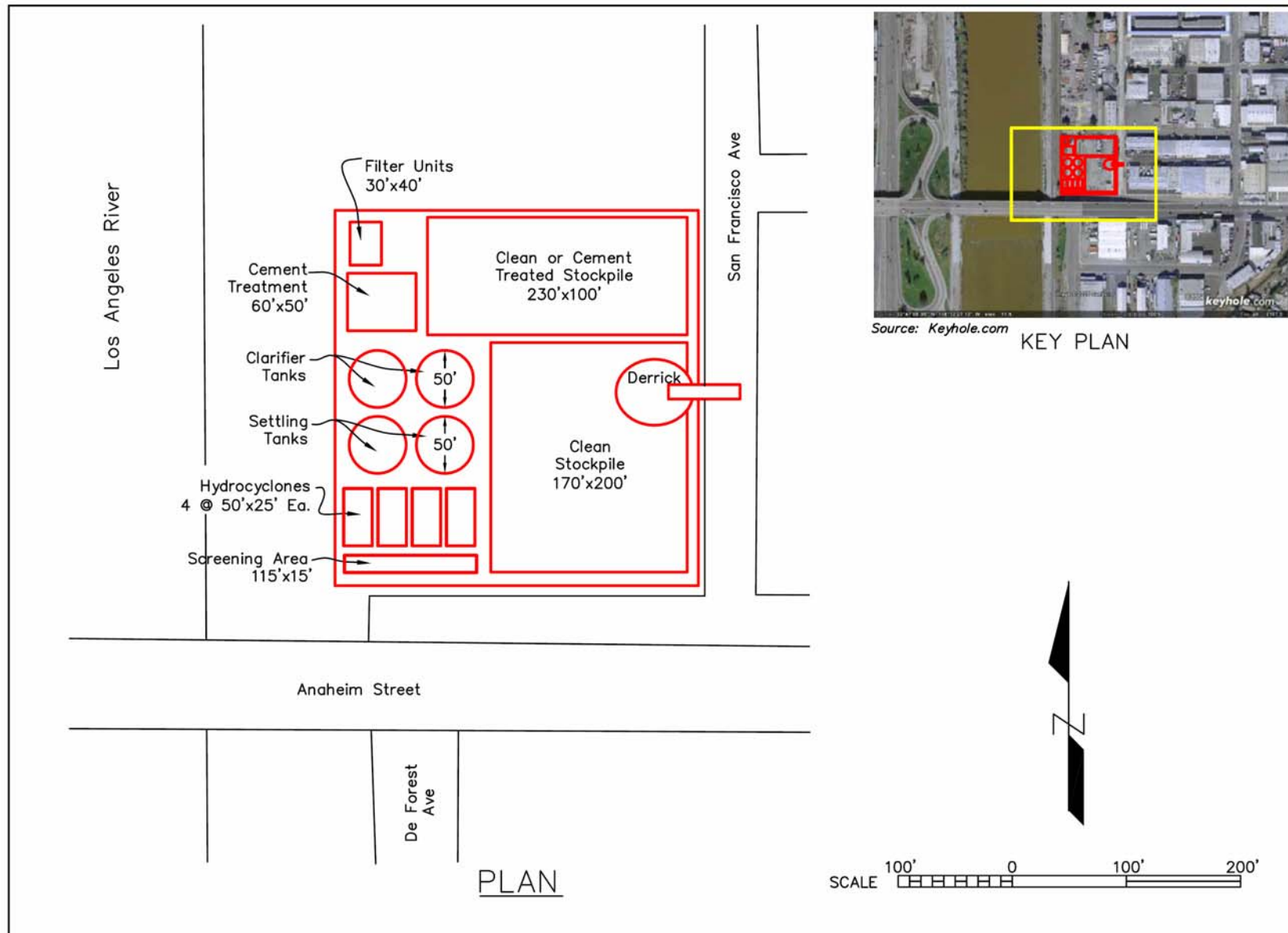
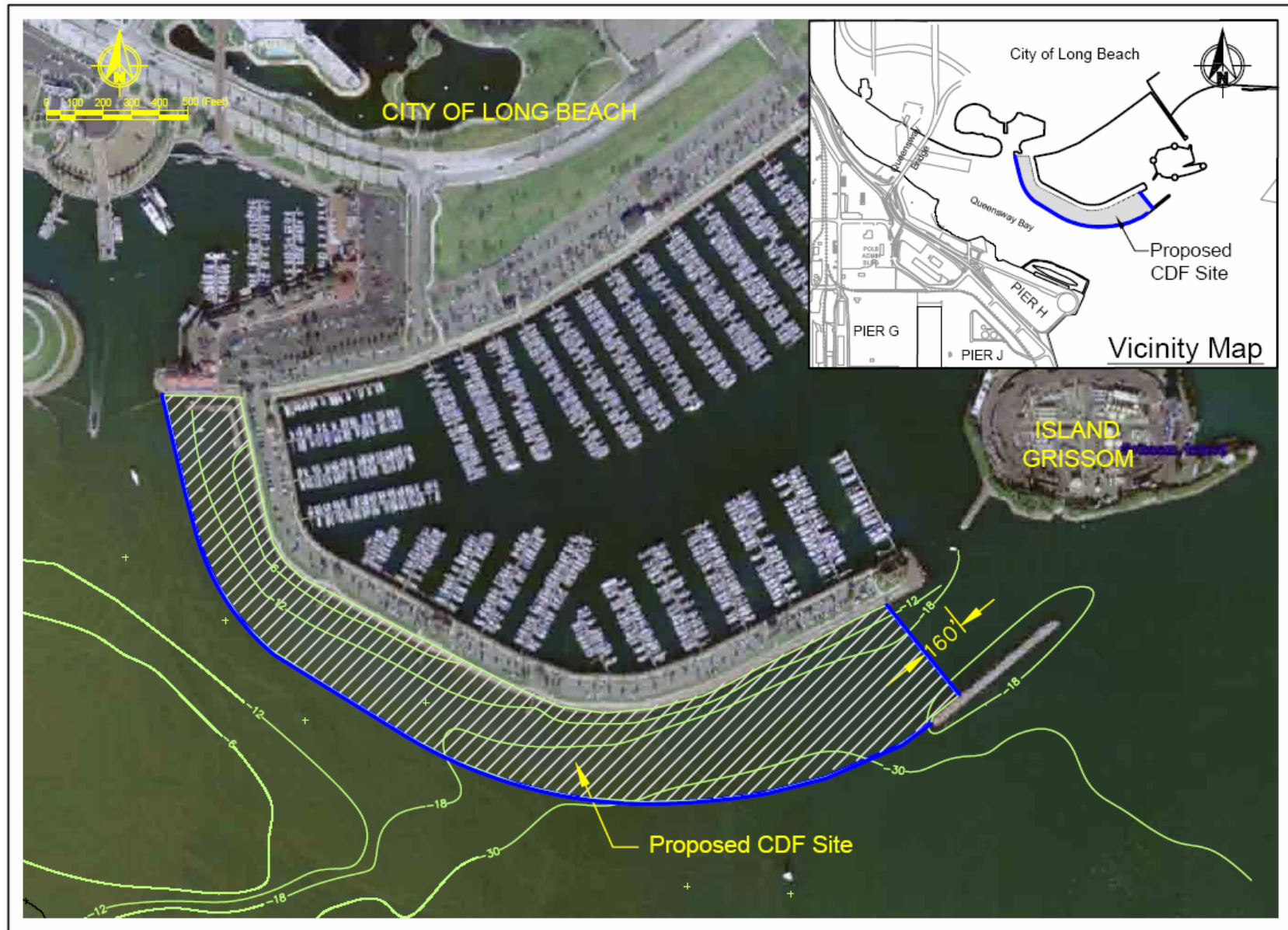


Figure 3.6 Anaheim Street Site



Source: Keyhole.com

**Figure 3.7 Proposed Long Beach CDF Site**

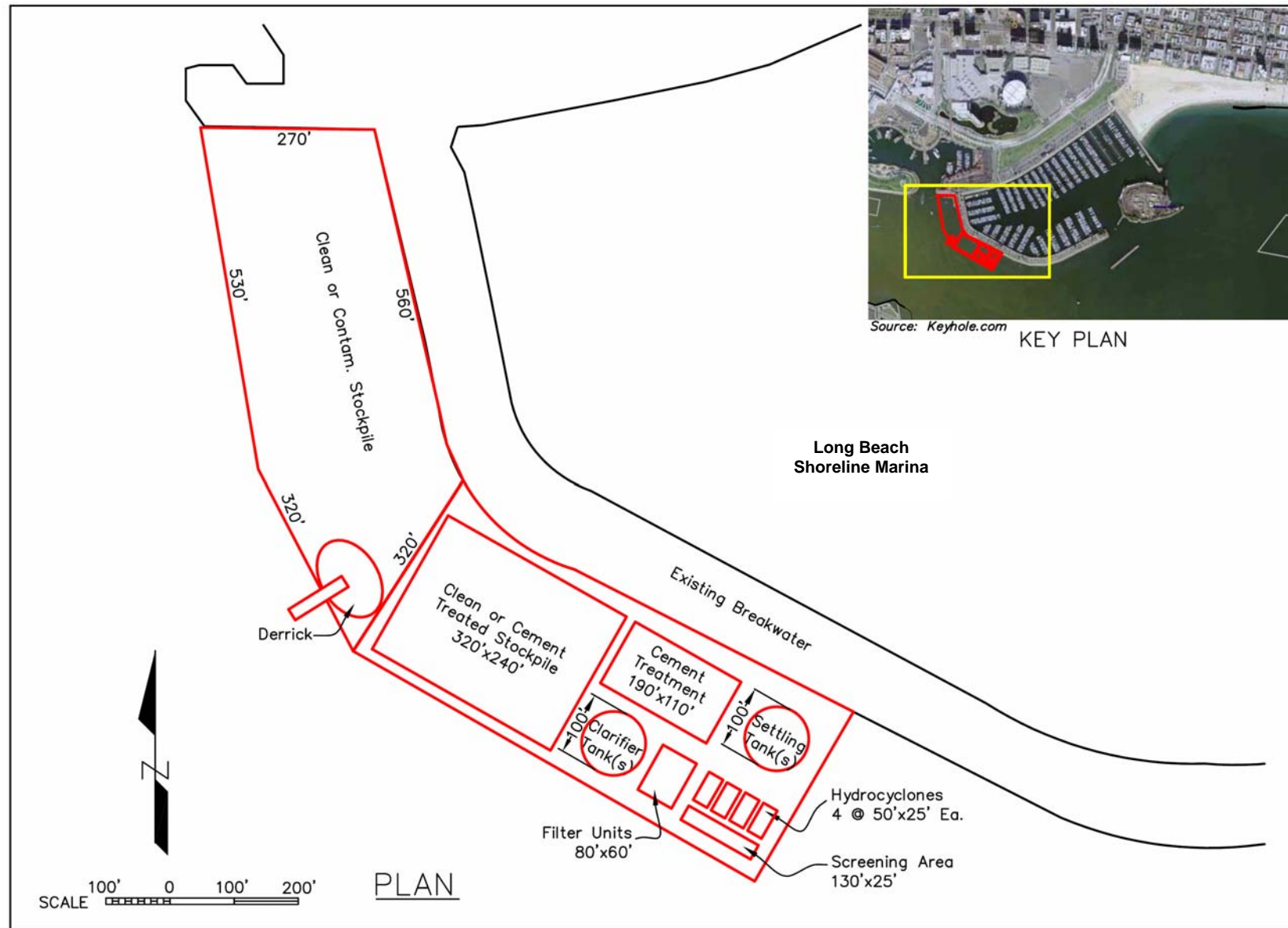


Figure 3.8 Long Beach Shoreline Marina Site

### **3.4 POTENTIAL PRODUCTION RATE AND OPERATION COST**

The production rate of a regional STAR facility will depend on the size of the facility and the number of hydroclones that can fit into the site. Based on conversations with various equipment vendors, it was estimated that 2-10" hydrocyclones can process about 440 – 600 cubic yards per day. The conceptual STAR facilities layouts for the Marina del Rey site and the two City of Long Beach sites (Figures 3.4, 3.6 and 3.7) are designed for the use of between 4 and 8 10" hydroclones. Hence, these conceptual facilities could process up to approximately 2,000 cubic yard per day.

As mentioned in Section 2.4, the costs associated with the pilot study presented in this technical memorandum are not directly applicable to an actual full-scale model for several reasons, including the following:

- The equipment used in the pilot study was not the most appropriate design for a full-scale treatment facility (larger cones are needed and a more efficient slurry tank must be designed);
- Because no upland space was available, the pilot study was conducted entirely on barges which caused significant inefficiencies in material handling and water treatment;
- The re-handling equipment that was used to move the dredge material from the dump scow to the processing barge was much larger (and more expensive) than what is actually required; and
- Constraints in the pilot schedule required that the material be triple handled before processing, which added significant costs.

Since completing the field pilot study, additional cost evaluations have been conducted to develop a cost estimate for operating a STAR facility. Using a target production rate of 2000 cubic yards per day, and assuming a similar treatment process as developed for the current pilot study, a treatment cost of between \$10-\$20/yard has been predicted. This cost assumes renting the equipment and hiring outside contractors to operate the various systems. There are several vendors in the United States that can provide the needed equipment, and each of their specific costs will vary. As such, providing detailed costs on a line item basis is not appropriate for this memorandum. The estimate provided herein, however, is similar to observed costs for facilities developed at other locations (e.g., Miami River and Clearwater Beach, Florida) so should be considered an accurate estimate of the production costs.



### **3.5 CONSTRUCTION AND PERMITTING**

Because the USACE (Federal Government) is not responsible for dredge material treatment and/or disposal, treatment facility construction would need to be designed and funded by one or more of the local dredging sponsors (e.g., City of Long Beach, County of Los Angeles, Port of Los Angeles, Port of Long Beach, etc.). Facility development would require the same local, State and Federal permits as any other capital development project. If the selected treatment design includes provisions for ongoing process water discharge, an National Pollutant Discharge Elimination System (NPDES) discharge permit will likely be required by the California State Water Board.

### **3.6 MODEL FOR LONG-TERM MANAGEMENT AND OPERATION**

The development and use of regional sediment treatment facilities is rare in the United States so finding a suitable model to base the current proposal on is difficult. Currently, the Los Angeles CSTF members, including the Corps-LAD have considered the following potential multi-use disposal scenarios for the region.

- Confined Disposal Facility (CDF)
- Confined Aquatic Disposal (CAD)
- Shallow Water Habitat Creation
- Upland Re-Handling/Processing Facility
- Upland Gravel Pit Disposal

While all five of these options have the potential to support disposal or processing by multiple parties, they can actually be separated into two categories, each with very different characteristics and ownership/management issues. A CDF or shallow water habitat is not really a multi-user facility, but rather an individually permitted project that occasionally allows disposal by multiple parties on an opportunistic basis. On the other hand, a CAD, upland re-handling facility, or upland gravel pit could easily be operated as multi-user disposal or processing facilities. Consider the following comparisons and contrasts:

<b>PROJECT SPECIFIC/SINGLE USER SITE FOR DISPOSAL OR BENEFICIAL REUSE</b> (CDF, SHALLOW WATER HABITAT)	<b>LONG TERM/MULTI-USER SITE FOR DISPOSAL OR BENEFICIAL REUSE</b> (CAD, UPLAND RE-HANDLING FACILITY, UPLAND GRAVEL PIT DISPOSAL)
<ul style="list-style-type: none"> <li>Individual project permitted based on specified fill material.</li> </ul>	<ul style="list-style-type: none"> <li>Open-ended permit with range of material types authorized for disposal.</li> </ul>
<ul style="list-style-type: none"> <li>Schedule driven by development plans and contract duration (typically, speed is of the essence to reduce costs).</li> <li>Very narrow window of opportunity for disposal by other parties.</li> </ul>	<ul style="list-style-type: none"> <li>Schedule driven by capacity.</li> <li>No disposal or processing windows.</li> <li>Typically permitted for disposal or processing for many years or decades.</li> </ul>
<ul style="list-style-type: none"> <li>Monitored during construction and possibly upon completion.</li> </ul>	<ul style="list-style-type: none"> <li>Monitored routinely during operation (i.e., commercial landfill) for regulatory compliance.</li> </ul>
<ul style="list-style-type: none"> <li>No tipping fees typically collected.</li> <li>Project cost is fixed and use of other fill material may offset import fill costs.</li> </ul>	<ul style="list-style-type: none"> <li>Tipping fees common to offset capital and management costs or facility operated for profit.</li> </ul>
<ul style="list-style-type: none"> <li>Contractor carries insurance bonds during construction to manage liability.</li> </ul>	<ul style="list-style-type: none"> <li>Owner/operator maintains long-term liability insurance similar to landfill.</li> </ul>

Both CDFs and shallow water habitat areas have been designed and constructed within the region so management strategies already exist for those scenarios. Many of the capital improvement projects (i.e., terminal development) within the ports of Los Angeles and Long Beach include the use of CDFs, and at least two examples exist for the development and creation of shallow water habitat areas (Cabrillo Shallow Water Habitat Area and Pier 400 Shallow Water Habitat Area). For both options, there are no outstanding ownership or management issues to resolve. Land is either privately owned or leased from the State of California and environmental impact assessments are conducted prior to construction and certified by the project proponent or CCC. Permit applications are reviewed and approved by the Water Board, EPA, and the Corps and disposal occurs as a single action. Long-term management is typically not required to monitor for contaminant release, but is frequently conducted to evaluate biological re-colonization.

True multi-user disposal/treatment sites (i.e., CAD, upland re-use facility, and upland gravel pit disposal) have not been developed within the region and there are no examples for suitable management and operation. Some of the unresolved issues associated with these sites include the following:

- No local sponsor(s) have been identified to fund or develop the site
- A suitable site has not yet been defined and analyzed
- Questionable market locally (per GeoSyntec Report (2003) for CSTF)

- Suitable processing technology not yet confirmed
- Operational and long-term liability
- Groundwater protection
- Host jurisdictions
- Environmental monitoring not defined
- Corrective action triggers and actions
- Administrative costs
- Maintenance



## **4. SUMMARY AND RECOMMENDATION**

Based on the results of the pilot treatment study, one or more sediment pre-treatment technologies should be sufficient for use as a regional treatment approach for contaminated sediments within the Los Angeles Region. The use of shaker screens and hydrocyclones to separate and recover clean, coarse sands from contaminated dredged material has been proven to be highly effective in producing a reusable sand product for beneficial reuse, while at the same time reducing the volume and weight of contaminated sediment requiring disposal.

The pilot study results further suggest that with refinement, this process could possibly provide an economical approach for sediment treatment at a regional STAR facility. Based on the need for the Los Angeles Region, and discussion with local sponsors for the DMMP study, three potential sites for a regional STAR facility have been identified. In addition, a conceptual design for a STAR facility is provided for each of the three sites. Each of the sites is designed to process about 2,000 cubic yards per day of contaminated material, with an estimated processing fee of about \$10 - \$20 per yard.

A recommendation for moving forward to further develop these three sites to become a regional STAR facility is warranted and includes the following administrative and technical action items:

### **Administrative Action Items**

- Identify a local sponsor and/or developer;
- Identify a suitable location for the facility;
- Identify and secure applicable environmental permits, development permits, etc.;
- Develop an operations and management plan for the facility;
- Develop a materials management and disposal plan for the facility;
- Identify insurance and liability requirements and draft legal agreements for material transfer;
- Assuming that the primary byproduct from the facility will be clean sand, coordinate site development with regional beach renourishment representatives (e.g., Corps-LAD, City of Long Beach, LA County Beaches and Harbors, San Diego Associations of Government) to identify and rank beach disposal needs and volumes.

**Technical Action Items**

- Finalize the design for treatment technologies to be included at the facility;
- Develop disposal and/or reuse options for the dewatered sludge material;
- Develop a wastewater treatment system to allow for direct discharge of treatment water; and
- Conduct another full-scale pilot study (10,000 cubic yards or greater) at an upland location to refine bulk sediment handling and slurry tank practices, as well as methods for reducing fine-grained material carry-over.

## **5. REFERENCE**

CSTF, 2005: "Los Angeles Basin Contaminated Sediments Task Force Contaminated Sediment Long-Term Management Strategy." Prepared for the Los Angeles Contaminated Sediment Task Force by Anchor Environments CA. L.P., Everest International Consultants, Inc., and AMEC Earth and Environment, Inc.

GeoSyntec. 2003. "Contaminated Sediments Market Evaluation: A Report on the Market for Beneficial Use of Contaminated Dredged Sediments in the Greater Los Angeles Area." Prepared for Southern California Coastal Water Research Project. Prepared by GeoSyntec Consultants.

USACE, 2005. "Sand Separation in Estuarine Sediments and Mechanical Dewatering for Management of Fine Residuals - Bench Scale Feasibility Testing." Prepared by Trudy Olin-Estes, P.E., Susan Bailey, Richard Shafer, P.E., Jim Fields, and Steve Cappellino.